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The Penetration of Mathematical Culture in Teaching Mathematics

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Abstract: Mathematical literacy constitutes an indispensable part of mathematical education. In order to prompt students' ability of solving problems, mathematical educators should take the responsibility to impart mathematical culture to students, guide them to grasp the mathematical thoughts and spirit, and provide corresponding practices. The reason lies on that one can extract the mathematical spirit and thinking patterns from such mathematic culture, which will benefit him throughout his life, even if he has forgotten mathematical concepts and corresponding properties.

Key words: Mathematical teaching; Reform of mathematical education; Teaching method; Mathematical culture

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1. INTRODUCTION

What is the mathematical culture? In a narrow sense, the mathematical culture [1] includes the thoughts, spirits, methods, viewpoints, and languages in mathematics as well as their origins and developments [2]. While, in a broader sense, the mathematical culture also contains the mathematical history as well as its relations and interactions with humanities and other forms of culture, which altogether constitute a large mathematical culture system. Therefore, the mathematical culture is

not only a collection of common characteristics, such as core values, thinking patterns, behaviors, shared by mathematical communities, but also plays important roles in cultivating one's viewpoints, thinking modes and other aspects. Actually, whenever solving mathematical problems, we are guided by certain mathematical spirits, thoughts and approaches. And in practical teaching activities, it is commonly believed that the grade that one student could obtain in a mathematical course is determined by his mathematical capability, the essence of which resides on the grasp and understanding of mathematical culture [3].

Unfortunately, traditional mathematical teaching methods always overemphasize on imparting knowledge and skills to students, ignoring the cultivation of students' comprehensive and systematic understandings of mathematics. Students are often forced to learn and receive knowledge in the context of exam-oriented teaching, because they often feel that the mathematical course is boring and have little passion. After graduated, 95% of students have little chance for learning and using mathematics again, resulting in that they will finally forget the concrete concepts or properties learnt in class, and only keeping mathematical spirits and thinking patterns in their mind. And these spirits and thinking patterns would continue to affect their future working. As said by some bosses when interviewing graduated students majoring in mathematics, "I don't need your mathematical knowledge, but your mathematical brain". Thus, it is of great importance in the mathematical teaching reform to bring mathematical culture into teaching contents, which could significantly arouse students' enthusiasm in learning mathematics and help them understand corresponding materials [4].

In this paper, we will focus on discussing the mathematical culture specifically in the following three aspects: the importance of the mathematical history; mathematical thoughts and approaches in solving problems and applications and recreation of mathematics.

2. IMPORTANCE OF MATHEMATICAL HISTORY

The connotation of mathematical culture not only relies on various concepts and approaches, but also on its history. China, an ancient country with a long history over five thousand years, gives birth to brilliant culture of mathematics, including a lot of famous mathematicians such as Hui Liu, Chongzhi Zu, and classic works such as the Nine Chapters on the Mathematical Art [5]. Teachers should, in mathematical teaching, make full use of these unique precious resources, and introduce historical materials (e.g., pi, the Pythagorean theorem and alike) to students, guiding them to know origins of concepts and approaches in mathematics and intelligence of ancient people.

For students, learning historical contents of mathematics contributes much to helping them master concepts and theorems, and promote abilities. Through this way, the students can not only obtain a sense of history, but also could be more accurate in understanding by standing on a new viewpoint. Moreover, the historic material can benefit students in thinking or understanding, developing their personality, provoking their learning interests, and learning more about the value of mathematical culture and applications. As for teachers, considering that the cognitive process of an individual should follow the one of human kind, historic material is an effect tool in mathematical teaching. Applying it in teaching yields a new way

for culture dissemination and education reform, which could significantly extend the teaching contents, and make teaching more nature and interesting.

3. THOUGHTS AND METHODS IN SOLVING MATHEMATICAL PROBLEMS

When encountering with a new mathematical problem, the general problem solving procedure are as the following. In the first step, we observe and analyze the known conditions as well as implicit conditions and unknown factors, based on which, in the second step, we search in our mind, and associate the observation results with known knowledge. Finally, we analyze all possible solutions, and find a right way to solve problems.

The thoughts and method constitute the sole of mathematics and the core of mathematical culture, which could be easily extended to other fileds. Mathematical thoughts and methods, such as from generality to particular, reducing the complexity to simplicity, induction, contrary thinking and so on, have been widely used in the mathematics. One can apply them flexibly, only if he has had concrete understanding. Thus, teachers should pay more attention on conveying mathematical thoughts and methods, to provoke students' enthusiasm and passion on learning.

Considering the huge number, and various kinds of mathematical problems, the solution varies dramatically in solving each individual problem. Some problems may be difficult seemingly. However, after being reduced into several simpler subproblems through certain skills, the origin complicated problem may be solved easily. For instance, in solving the multivariate calculus, we can transform a multivariate calculus problem into the calculus of one variable, by which the original problem could be tackled easily.

There are many other thoughts and methods, which reside in different mathematical problems, and need further explorations. In fact, we also frequently use the mathematical thoughts, analogy for example, in practical engineering and our daily life. This is not only the application of mathematical thought and culture, but also a manifestation of mathematical culture.

4. APPLICATION AND RECREATION OF MATHEMATICS

Mathematics is so highly abstract that it is very difficult to understand well. So, teachers should help cultivate students' abilities of application and recreation via studying practical cases, from the thinking patterns and knowledge, representing the mathematical culture. Throughout the history of mathematics, so many mathematicians devote their whole life, unaware of various practical difficulties, to resolving the problems that are impossible to make out by using existing knowledge. It is their innovations that lead mathematics to be developed further. For example, at the birth of calculus, there wasn't convincing explanation for concepts of infinitesimal. The Belet paradox, proposed by the British archbishop Belet, made many mathematicians lose their confidence about calculus. Similar examples can be found during the development of mathematics. If the human society advances along with creation, so as to mathematics. Spirits of innovation and recreation is born with the birth of mathematics, so that millions of people spare no efforts to learn, to develop, and to create mathematics.

In the heuristic teaching, both teachers and students can fully play the guiding and leading roles, respectively. As a result, positive factors in teaching are enhanced, and the quality is improved. Most importantly, students' skills in finding, analyzing and solving problems are significantly promoted. For instance, when explaining the scaling of inequalities, teachers can introduce a scenario that they have a glass of water together with some sugar, and ask the students whether the water would become sweeter after mixed with sugar. There is no doubt that water is sweeter after adding more sugar. By introducing the aforementioned real scenario, teachers can then introduce the inequality scaling more naturally. The teachers could begin with special cases and inspire students to hypothesis and reasoning bravely, in order to induce them to find and recreate. As long as appropriate ways for learning are utilized, students' innovation ability can be cultivated and exploited. By introducing practical problems, students are enlightened to think and explore the mathematical knowledge, and their ability of applying knowledge to practical problems will be promoted. This is another manifestation of mathematical culture.

5. CONCLUSION

Mathematical teaching is not only for imparting mathematical knowledge, but also for improving students' capacity, which is more important. Conducted by various teaching method, students will learn knowledge of mathematics, and meanwhile be absorbed in mathematical culture. Their understanding on mathematics will be enhanced, together with their ability for creation, which will benefit them throughout their lives.

REFERENCES

[1] Zhang, Y. (2006). *The understanding and practicing of mathematical cultural education*. PhD dissertation, Sichuan: Sichuan Normal University, China.

[2] Han, H., & Wang, W. H. (2007). Discussion on the combination of mathematical history teaching with traditional mathematical education. *China University Teaching*, (12), 21–23.

[3] Peng, K. Q., & Yu, W.Y. (2010). Elevating the nonintellectual factor of college student is the essence of innovation education. *Education Research Monthly*, (7), 108–109.

[4] Wang, L.X. (2005). Improving mathematical teaching by the mathematics culture. *Education in Tian Jin*, (6), 29–30.

[5] Zhu, Z., & Song, N. Q. (2003). Introduction mathematical history into mathematical courses. *Journal of Mathematics Education*, (6), 35–37.